

It is likely that these fish consumption estimates are conservative due to assumptions made in the analysis. For example, a 40 percent assumption was used in this analysis to estimate the edible portion of landlocked and Atlantic salmon. As there is no specific edible portion data in the published literature, this was based on the results of a whole/edible portion study of landlocked salmon conducted on the West Branch of the Penobscot River (Ebert, 1991a) for which the mean edible portion was determined to be 37 percent. Because Atlantic salmon are the same species and are likely to be more muscular than landlocked salmon (Personal communication, J. Trial, 1991), the 95th upper confidence limit of 40 percent was used to estimate edible portion for these fish. This is extremely conservative as Atlantic salmon represented only 0.5 percent of the total fish mass consumed by resident anglers (Table 4). In addition, the edible portion of West Branch landlocked salmon is likely to be greater than that of landlocked salmon from other locations within the State because of a higher condition factor, i.e., the fish are fatter (Personal communications, J. Trial, E. Spear, 1991). Consequently, the use of an assumed edible portion of 40 percent for all salmon may substantially overestimate the actual mass of salmon consumed. Landlocked salmon comprised 17 percent of the total fish mass consumed by anglers.

Due to the inclusion of future trip estimates, it is likely that fish consumption rates, for those individuals reporting intended future trips, have been overstated. Question 25 of the survey asked anglers to estimate the number of days they expected to fish during the remainder of 1990. Although the open water fishing season on most waterbodies ends on September 30, limited fishing is allowed until October 15 or 30 on certain waterbodies. It was considered important that these future fishing trips be considered in the analysis. For the estimation of consumption, it was assumed that the intended number of future fishing trips would actually be taken. In addition, it was assumed that the average success and consumption rates for the individual angler during the trips already taken would continue through future trips.

It is likely that this approach overestimates the number of future fishing trips actually taken and the number of fish consumed as a result of those trips. Survey participants are likely to over-report the number of trips that will be taken in the future (Personal communication, K. Boyle, 1991). Factors like poor weather and unplanned other commitments may prevent anglers from initiating trips that they intended to take at the time of the survey. In addition, the availability of fish generally decreases in the Fall (personal communications, E. Spear, K. Boyle, O. Fenderson, 1991). Harvest rate (fish per trip) would, most likely, be lower in the Fall than during the summer months. Consequently, the contribution to total fish consumption represented by future trips

estimates very likely results in an overestimation of the total fish consumption rates for all waters and for flowing waters.

It is also likely that estimated fish consumption rates are over-reported due to survey biases. Chase and Harada (1984) have reported that participants responding to self-report surveys tend to overreport their actual participation in recreational activities. Similar results were reported by Soldat (1970) in his survey of Columbia River anglers. In a study done for the U.S. Fish and Wildlife Service, Westat, Inc. (1989) reported that a one-year recall period produced "substantial overestimates" of fishing statistics. Factors that can affect reporting include the length of the recall period, the frequency of the fishing trips, interest in or importance of the activity to the individual, and the perceived social desirability (prestige bias) of the activity. Similar biases have been reported in other studies of recreational activities (Ghosh, 1977; Chase & Godbey, 1983).

The length of recall period, the self-reporting nature of the survey, the social desirability of the sport, and the frequency of fishing trips are all contributing factors which are likely to result in overestimates of consumption. Avid anglers are likely to fish more frequently and experience a higher degree of success than less avid anglers. Thus, it can be assumed that avid anglers are among the highest consumers of freshwater fish. As overreporting appears to be correlated with skill level and importance of the activity to the individual, it is likely that the higher consumption rates may be substantially overstated.

It is likely that consumption of riverine fish has been further overestimated in this analysis due to the inclusion of smelt and adult Atlantic salmon. Neither of these species resides in Maine's rivers. Rather, they are found in Maine rivers only during their spawning runs. Their inclusion in consumption estimates is likely to overstate the consumption of riverine species.

The results of this survey indicate that the consumption of freshwater fish by Maine's anglers and their families is low. This is not surprising given the commercial and recreational availability of saltwater fish. The consumption rate estimates for the "typical individual" in each of the four groups of anglers and their families are all well below the EPA's (1984) recommended per capita estimate of 6.5 g/day. In fact, the EPA's estimate of 6.5 g/day represents the 96th percentile of consumption from this survey for all river anglers and the 92nd percentile of consuming river anglers.

This study demonstrates that a freshwater fish consumption rate of approximately 1 g/day is the most appropriate value for use in a risk assessment upon which to base a health-protective water quality standard for dioxin in the State of Maine. This estimate is based on information provided by Maine's resident anglers. Because consuming Maine anglers and their families are the highest consumers of Maine's freshwater fish, use of this consumption rate would be adequate to protect the health of Maine residents. This statewide mail survey provides convincing evidence that the use of a this fish consumption rate for standard-setting in Maine is appropriate and conservative.

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APPENDIX A
ADVANCE LETTER

HBRS, Inc.

University Research Park • 585 Science Drive • Madison, Wisconsin 53711
(608) 231-1011 • Fax (608) 231-3416

Dear Freshwater Angler:

It is important to monitor both the catch and consumption of freshwater fish from the waters of Maine. To help estimate catch and consumption of freshwater fish, we need you to tell us about your angling experiences. You are one of a small group of 1989 Maine resident fishing license holders selected to participate in this study.

HBRS, Inc., a professional research firm has been hired to conduct this study. Within the next few days, you should receive a survey in the mail about freshwater fishing. You will receive a postage-paid envelope so the completed survey can be mailed directly back to our offices.

We would like to thank you in advance for your help in this study. Please watch for the survey in the mail in the next few days.

Sincerely,



Michael P. Welsh
Project Manager

APPENDIX B

COVER LETTER

HBRS, Inc.

University Research Park • 585 Science Drive • Madison, Wisconsin 53711
(608) 231-1011 • Fax (608) 231-3416

Dear Freshwater Angler:

Here is the Maine Freshwater Fishing survey I told you about in our letter a few days ago. This survey asks about the details of freshwater fishing trips you have taken in the past year, especially the number and kinds of fish you may have caught and eaten. People who have filled it out say it takes about 15-20 minutes to complete--sometimes more, sometimes less.

You are one of a small number of freshwater anglers who are being asked to represent the many different types of freshwater anglers in Maine. Even if you go freshwater fishing only once or twice a year, we would like to hear from you. Your answers are very important because they reflect your views and experiences, as well as the views and experiences of other freshwater anglers like you.

Your answers to this survey will help us to understand how many trips are made by Maine's freshwater anglers, how many and what kinds of fish are caught, and the number of fish taken home and eaten. Data collected during this study will be shared with Maine's resource management agencies.

Your responses are confidential, and your name will not be revealed. Information from the surveys will only be reported in statistical terms, such as "10 percent of freshwater fishing trips took place on the Penobscot River". There is an identification number on the back of your survey so that we know who to send reminders to and can avoid recontacting those who have already returned the survey.

HBRS, Inc., a professional research firm, has been hired to help design and conduct this study in cooperation with several Maine consultants. Please return your completed survey to us in the enclosed stamped, self-addressed envelope.

If you have any questions on this study, please feel free to call Mike Welsh or Lori Langer collect at HBRS, Inc. Our number is (608) 231-1011. Thank you for your help with this study.

Sincerely,



Michael P. Welsh
Project Manager

P.S. Please accept the small gift enclosed as a token of our appreciation for your help in this study.

APPENDIX C
QUESTION & ANSWER SHEET

More Information About the Maine Freshwater Fishing Study

Q. How was I selected to participate in this study?

A. Your name was selected from those who have purchased a Maine resident fishing license in 1989.

Q. How many people are being asked to fill out this survey?

A. Only about 2,500 freshwater anglers have been selected to take part in this study. Since this is a relatively small number of anglers, everyone's answers are very important.

Q. What is the purpose of this study?

A. The major purpose of this study is to find out what types and the number of fish that are caught and consumed in Maine waterways in a year.

Q. What if I only go freshwater fishing a few times a year, do you really want me to answer the survey?

A. Yes. There are many people in Maine who only go freshwater fishing once or twice a year. Your responses are important because they represent the experience of many anglers like you.

Q. Will my name be used?

A. ABSOLUTELY NOT! Our survey records are confidential. The only reason we keep any record of your name is to mail you a reminder if you haven't returned the completed survey. You may be assured that no personal information will be revealed.

Q. What if I have questions about the survey?

A. If you have questions about this survey, please call Mike Welsh or Lori Langer collect at HBRs, Inc. Their number is (608) 231-1011.

APPENDIX D

SURVEY

Maine Freshwater Fishing Study



This survey is about your freshwater fishing experiences in Maine. Your name was selected because you purchased a Maine resident fishing license in 1989.

1. About how old were you when you took your first freshwater fishing trip in Maine? (FILL IN BLANK)

_____ years old the first time I ever fished in Maine .

2. How would you describe your fishing ability? (CIRCLE ONE NUMBER)

1 2 3 4 5
Novice Intermediate Expert

3. Did you go freshwater fishing in Maine in 1989? (CIRCLE ONE NUMBER)

1 No
2 Yes

4. Did you go fishing in Maine during either the 1989-1990 ice fishing season or during the 1990 open-water fishing seasons? (CIRCLE ONE NUMBER)

1 No
2 Yes _____ > Skip to Question 6

5. What was the most important reason why you did not go fishing during the 1989-1990 ice fishing season or the 1990 open-water seasons? (CIRCLE ONE NUMBER)

1 Health problems
2 Too busy with other activities
3 I lost my interest in fishing
4 Other (please describe: _____)

If you didn't fish during the 1989-1990 ice fishing season or make any 1990 open-water fishing trips, please skip to Question 25.

6. We would like to know more about the factors or site characteristics that are important in choosing the location where you fish. Please indicate how important each factor or site characteristic, listed below, is to you. (CIRCLE ONE NUMBER FOR EACH CATEGORY)

	Not Important	Somewhat Important	Very Important
Easy access from a road	1	2	3
Availability of public access	1	2	3
Maintained boat launch	1	2	3
Type of water (pond, river, etc.)	1	2	3
Size of body of water	1	2	3
Easy to fish from the shore	1	2	3
Special fishing regulations	1	2	3
Chance of catching a trophy fish	1	2	3
Desirable species of fish	1	2	3
Chance to catch many fish	1	2	3
Past fishing success	1	2	3
Not likely to get skunked	1	2	3
Location where friends fish	1	2	3
Few anglers	1	2	3
Beauty of surrounding area	1	2	3
Close to motels, restaurants, etc.	1	2	3
Close to my home	1	2	3
Close to my camp	1	2	3

In the next section, we would like to learn about your 1989-1990 ice fishing trips. If you cannot recall the exact details, please answer with your best estimates.

7. Did you take any ice fishing trips in Maine during the 1989-1990 ice fishing season? (CIRCLE ONE NUMBER)

1 No —————> Skip to Question 12
2 Yes

8. During the 1989-1990 ice fishing season, on how many different days did you spend part or all of the day ice fishing? (FILL IN BLANK)

_____ days fished during the 1989-1990 ice fishing season

9. During your 1989-1990 ice fishing trips, on average, how many hours per day did you spend ice fishing? (FILL IN BLANK)

_____ hours per day ice fishing

10. Did you catch any fish during your 1989-1990 ice fishing trips? (CIRCLE ONE NUMBER)

1 No —————> Skip to Question 12
2 Yes

11. This question is about the number and kinds of fish you personally caught during the 1989-1990 ice fishing season in Maine, and what happened to these fish. If you didn't catch a particular kind of fish during the 1989-1990 ice fishing season, just leave that line blank. (FILL IN BLANKS)

	How Many Did You Catch?		What Did You Do with the Fish You Caught?			On Average, How Big Were the Fish That Were Eaten?
	Number Caught	Number Released	Number Given Away, Thrown Away, Used for Bait or Fed to Pets	Number Eaten by You and/or a Household Member		
Landlocked Salmon	_____ -->	_____	_____	_____ -->	_____ in.	
Atlantic Salmon	_____ -->	_____	_____	_____ -->	_____ in.	
Togue (Lake Trout)	_____ -->	_____	_____	_____ -->	_____ in.	
Brook Trout	_____ -->	_____	_____	_____ -->	_____ in.	
Brown Trout	_____ -->	_____	_____	_____ -->	_____ in.	
Yellow Perch	_____ -->	_____	_____	_____ -->	_____ in.	
White Perch	_____ -->	_____	_____	_____ -->	_____ in.	
Bass (small mouth and large mouth)	_____ -->	_____	_____	_____ -->	_____ in.	
Pickeral	_____ -->	_____	_____	_____ -->	_____ in.	
Lake Whitefish	_____ -->	_____	_____	_____ -->	_____ in.	
Hornpout (Catfish and Bullheads)	_____ -->	_____	_____	_____ -->	_____ in.	
Bottom Fish (Suckers, Carp, and Sturgeon)	_____ -->	_____	_____	_____ -->	_____ in.	
Chub	_____ -->	_____	_____	_____ -->	_____ in.	
Smelt	_____ -->	_____	_____	_____ -->	_____ in.	
Other (please describe: _____)	_____ -->	_____	_____	_____ -->	_____ in.	

The previous section asked about the fish you caught during the 1989-1990 ice fishing season. This section asks about the fish you caught during the 1990 open-water fishing season. If you cannot recall the exact details, please answer with your best estimates.

12. Have you made any open-water fishing trips in Maine during 1990?

- 1 No ————— > Skip to Question 25
- 2 Yes

13. Have you taken any open-water fishing trips during 1990 to any ponds or lakes in Maine? (CIRCLE ONE NUMBER)

- 1 No ————— > Skip to Question 17
- 2 Yes

14. During 1990, on how many different days did you spend part or all of the day open-water fishing on ponds or lakes in Maine? (FILL IN BLANK)

_____ different days fished on ponds or lakes in Maine

15. During your 1990 open-water fishing trips, on average, how many hours per day did you spend fishing on ponds or lakes in Maine? (FILL IN BLANK)

_____ hours per day fishing on ponds or lakes in Maine

16. On your 1990 open-water fishing trips, how did you usually fish when you fished on ponds or lakes in Maine? (CIRCLE ONE NUMBER)

- 1 From the shore or bank only
- 2 From a boat or canoe only
- 3 From both the shore or bank and a boat or canoe
- 4 Other (please describe: _____)

17. Did you take any 1990 open-water fishing trips on any streams or rivers in Maine? (CIRCLE ONE NUMBER)

1 No _____ > Skip to Question 21
2 Yes

18. During 1990, on how many different days did you spend part or all of the day open-water fishing on streams or rivers in Maine? (FILL IN BLANK)

_____ different days fished on streams or rivers in Maine

19. During your 1990 open-water fishing trips, on average, how many hours per day did you spend fishing on streams or rivers in Maine? (FILL IN BLANK)

_____ hours per day fishing on streams or rivers in Maine

20. On your 1990 open-water fishing trips, how did you usually fish when you fished on streams or rivers in Maine? (CIRCLE ONE NUMBER)

1 From the shore or bank only
2 From a boat or canoe only
3 From both the shore or bank and a boat or canoe
4 Other (please describe: _____)

21. During your 1990 open-water fishing trips in Maine, which freshwater bodies did you fish most frequently? (FILL IN BLANKS)

Name of Water Body	Type of Water Body (flowing or standing)	Nearest Town or City	Number of Days Fished There	Distance from Home
_____	_____	_____	_____	_____ miles
_____	_____	_____	_____	_____ miles
_____	_____	_____	_____	_____ miles
_____	_____	_____	_____	_____ miles
_____	_____	_____	_____	_____ miles

22. Did you catch any fish during your 1990 open-water fishing trips? (CIRCLE ONE NUMBER)

- 1 No _____ > Skip to Question 25
2 Yes

23. This question asks about the number of fish you caught during your 1990 open-water fishing trips, and what happened to these fish. If you didn't catch a particular type of fish on your 1990 open-water fishing trips, just leave that line blank. (FILL IN BLANKS)

	How Many Did You Catch?		What Did You Do with the Fish You Caught?		
	Number Caught		Number Released	Number Given Away, Thrown Away, Used for Bait or Fed to Pets	Number Eaten by You and/or a Household Member
Landlocked Salmon	_____	_____ >	_____	_____	_____
Atlantic Salmon	_____	_____ >	_____	_____	_____
Togue (Lake Trout)	_____	_____ >	_____	_____	_____
Brook Trout	_____	_____ >	_____	_____	_____
Brown Trout	_____	_____ >	_____	_____	_____
Yellow Perch	_____	_____ >	_____	_____	_____
White Perch	_____	_____ >	_____	_____	_____
Bass (small mouth and large mouth)	_____	_____ >	_____	_____	_____
Pickeral	_____	_____ >	_____	_____	_____
Lake Whitefish	_____	_____ >	_____	_____	_____
Hornpout (Catfish and Bullheads)	_____	_____ >	_____	_____	_____
Bottom Fish (Suckers, Carp, and Sturgeon)	_____	_____ >	_____	_____	_____
Chub	_____	_____ >	_____	_____	_____
Smelt	_____	_____ >	_____	_____	_____
Other (please describe: _____)	_____	_____ >	_____	_____	_____

24. In the last question you indicated how many of the fish that you caught were eaten by you and/or other household members. Of the fish reported as eaten in Question 23, how many were from flowing waters (streams and rivers) and how many were from standing waters (such as ponds or lakes)? (FILL IN BLANKS)

	Number eaten from flowing waters (streams, rivers)	Average length of these fish	Number eaten from standing waters (lakes, ponds)	Average length of these fish
Landlocked Salmon	_____ -->	_____ in.	_____ -->	_____ in.
Atlantic Salmon	_____ -->	_____ in.	_____ -->	_____ in.
Togue (Lake Trout)	_____ -->	_____ in.	_____ -->	_____ in.
Brook Trout	_____ -->	_____ in.	_____ -->	_____ in.
Brown Trout	_____ -->	_____ in.	_____ -->	_____ in.
Yellow Perch	_____ -->	_____ in.	_____ -->	_____ in.
White Perch	_____ -->	_____ in.	_____ -->	_____ in.
Bass (small mouth and large mouth)	_____ -->	_____ in.	_____ -->	_____ in.
Pickeral	_____ -->	_____ in.	_____ -->	_____ in.
Lake Whitefish	_____ -->	_____ in.	_____ -->	_____ in.
Hornpout (Catfish and Bullheads)	_____ -->	_____ in.	_____ -->	_____ in.
Bottom Fish (Suckers, Carp, and Sturgeon)	_____ -->	_____ in.	_____ -->	_____ in.
Chub	_____ -->	_____ in.	_____ -->	_____ in.
Smelt	_____ -->	_____ in.	_____ -->	_____ in.
Other (please describe: _____)	_____ -->	_____ in.	_____ -->	_____ in.

25. Do you plan to take any open-water fishing trips in Maine in the remainder of 1990? (CIRCLE ONE NUMBER)

1 No

2 Yes-----> On how many more days in 1990 will you spend part or all of the day fishing on open-waters in Maine? (FILL IN BLANK)

_____ more days in 1990

In the last two sections we asked about the fish you personally caught in Maine in 1990. This next section asks about the freshwater fish caught in Maine during the open-water or ice fishing seasons in 1990 by other household members.

26. Did any members of your household besides yourself make any open-water fishing trips during 1990 or ice fishing trips during the 1989-1990 ice fishing season in Maine? (CIRCLE ONE NUMBER)

1 No-----> Skip to Question 30

2 Yes

27. Besides yourself, how many other members of your household have been freshwater fishing in Maine during either the 1990 open-water or the 1989-1990 ice fishing season? (FILL IN BLANK)

_____ Other household member(s)

28. Did you or anyone in your household eat the fish caught by these other household members during either the 1989-1990 ice fishing season or the 1990 open-water seasons? (CIRCLE ONE NUMBER)

1 No-----> Skip to Question 30

2 Yes

29. Approximately how many of the fish caught by other members of your household in Maine during either the 1989-1990 ice fishing season or the 1990 open-water seasons were eaten by you and/or members of your household? (FILL IN BLANKS)

	Number Eaten ———>	Average Length of These Fish
Landlocked Salmon	_____	_____ in.
Atlantic Salmon	_____	_____ in.
Togue (Lake Trout)	_____	_____ in.
Brook Trout	_____	_____ in.
Brown Trout	_____	_____ in.
Yellow Perch	_____	_____ in.
White Perch	_____	_____ in.
Bass (small mouth and large mouth)	_____	_____ in.
Pickeral	_____	_____ in.
Lake Whitefish	_____	_____ in.
Hompout (Catfish and Bullheads)	_____	_____ in.
Bottom Fish (Suckers, Carp, and Sturgeon)	_____	_____ in.
Chub	_____	_____ in.
Smelt	_____	_____ in.
Other (please describe: _____)	_____	_____ in.

30. Since December 1989, have you or someone in your household eaten any freshwater fish that were caught in Maine by people outside of your household? (Do not include fish purchased at a store or fish market.) (CIRCLE ONE NUMBER)

1 No ———> Skip to Question 32
2 Yes

31. Approximately how many fish caught by non-household members in Maine since December 1989 were eaten by you and/or members of your household? (FILL IN BLANKS)

	Number Eaten	-----> Average Length of These Fish
Landlocked Salmon	_____	_____ in.
Atlantic Salmon	_____	_____ in.
Togue (Lake Trout)	_____	_____ in.
Brook Trout	_____	_____ in.
Brown Trout	_____	_____ in.
Yellow Perch	_____	_____ in.
White Perch	_____	_____ in.
Bass (small mouth and large mouth)	_____	_____ in.
Pickeral	_____	_____ in.
Lake Whitefish	_____	_____ in.
Hornpout (Catfish and Bullheads)	_____	_____ in.
Bottom Fish (Suckers, Carp, and Sturgeon)	_____	_____ in.
Chub	_____	_____ in.
Smelt	_____	_____ in.
Other (please describe: _____)	_____	_____ in.

32. Below, please describe the age and sex of each household member and indicate whether they eat freshwater fish caught in Maine (whether caught by you, another household member, or non-household member). (FILL IN BLANK)

	Age of Person	Sex of Person (CIRCLE ONE ANSWER)		Does This Person Eat Freshwater Fish Caught in Maine? (CIRCLE ONE ANSWER)	
Yourself	_____	Male	Female	No	Yes
Member 1	_____	Male	Female	No	Yes
Member 2	_____	Male	Female	No	Yes
Member 3	_____	Male	Female	No	Yes
Member 4	_____	Male	Female	No	Yes
Member 5	_____	Male	Female	No	Yes

There are many ways in which people prepare freshwater fish they catch. We would like to find out how you prepare freshwater fish from Maine caught by you, another household member or non-household members.

33. What three types of freshwater fish from Maine (whether caught by you, someone else in your household, or a non-household member) do you eat most often and how do you usually cook them? **(FILL IN SPECIES OF FISH IN BLANKS BELOW AND ANSWER EACH QUESTION)**

	Species 1: <small>(fill in blank)</small>	Species 2: <small>(fill in blank)</small>	Species 3: <small>(fill in blank)</small>
Do you fillet these fish before cooking them?	No Yes	No Yes	No Yes
Do you cook these fish with the skin on?	No Yes	No Yes	No Yes
Do you usually eat the liver of these fish?	No Yes	No Yes	No Yes
Do you usually eat the roe (eggs) from these fish?	No Yes	No Yes	No Yes
<p>About how many of these fish do you eat fresh (not frozen, smoked or canned)? (WRITE ONE NUMBER FROM BELOW)</p> <p>1 = All (100 %) 2 = Most (67 - 99%) 3 = About half (34 - 66%) 4 = Some (1 - 33%) 5 = None (0%)</p>	_____	_____	_____
<p>How do you usually serve these fish? (WRITE ONE NUMBER FROM BELOW IN BLANK FOR EACH SPECIES OF FISH)</p> <p>1 = Raw 2 = Baked 3 = Broiled/grilled 4 = Fried 5 = Poached 6 = Boiled 7 = Soup/stew/chowder</p>	_____	_____	_____

34. What do you usually do with fish leftover from a meal? (CIRCLE ONE NUMBER)

- 1 Never have leftover fish
- 2 Save leftovers to eat later
- 3 Throw leftovers away
- 4 Other (please describe: _____)

35. Do you and/or other household members ever eat freshwater fish (whether fresh or frozen) purchased from a store or fish market? (CIRCLE ONE NUMBER)

- 1 No _____ > Skip to Question 38
- 2 Yes

36. About how many meals of freshwater fish purchased from a store or fish market does your household have in a month? (FILL IN BLANK)

_____ freshwater fish meals per month

37. What is the average serving size of the freshwater fish at these meals per individual? (FILL IN BLANK)

_____ ounces of freshwater fish per individual

Some people have raised health concerns about water quality in public waterways. We would like to learn about any concerns you might have about the areas you fish.

38. Are you aware of any official fish consumption advisories concerning fish caught in Maine? (CIRCLE ONE NUMBER)

- 1 No _____ > Skip to Question 45
- 2 Yes

39. The following are some statements about fish consumption advisories in Maine. For each statement, indicate whether each statement is true, false, or if you don't know. Don't worry if these questions seem hard; very few people know all of the answers. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	True	False	Don't Know
The existing fish consumption advisories apply only to fish caught in lakes and ponds	T	F	DK
Only some rivers in Maine are the subject of fish consumption advisories	T	F	DK
The fish consumption advisories recommend that no one eat any fish caught in locations covered by the advisory	T	F	DK
The fish consumption advisories cover only certain species	T	F	DK
The fish consumption advisories cover all sizes of fish	T	F	DK

40. During 1990, did you ever fish at locations covered by an official fish consumption advisory? (CIRCLE ONE NUMBER)

- 1 No ————— > Skip to Question 44
- 2 Yes
- 3 Don't Know ————— > Skip to Question 45

41. Do fish consumption advisories affect whether you keep the fish caught at locations covered by fish consumption advisories? (CIRCLE ONE NUMBER)

1 No

2 Yes———>How do they affect whether you keep the fish you catch?
(CIRCLE ALL THAT APPLY)

1 I keep no fish

2 I keep fewer fish

3 I keep only the smaller fish

4 I keep only certain species

5 Other (please describe: _____
_____)

42. Do fish consumption advisories affect whether you eat the fish caught at locations covered by fish consumption advisories? (CIRCLE ONE NUMBER)

1 No

2 Yes———>How do they affect whether you eat the fish you catch?
(CIRCLE ALL THAT APPLY)

1 I don't eat any of the fish

2 I eat only the smaller fish

3 I eat only certain species

4 Other (please describe: _____
_____)

43. Do fish consumption advisories affect how you prepare and serve the fish caught at locations covered by a fish consumption advisory? (CIRCLE ONE NUMBER)

1 No

2 Yes———>How do they affect how you prepare and serve the fish?
(CIRCLE ALL THAT APPLY)

1 I only broil or grill these fish

2 I trim and discard any dark flesh

3 I trim off all fat

4 I trim off the lateral line

5 Other (please describe: _____
_____)

44. Suppose conditions were different so that there were no fish consumption advisories in Maine. Would you have fished any additional bodies of water during the 1989-1990 ice fishing season or 1990 open-water seasons? (CIRCLE ONE NUMBER)

1 No

2 Yes----->Which bodies of water? (FILL IN BLANKS)

In this last section of the survey, we would like to learn more about your background and your current household characteristics. You can be assured that all your answers will be kept confidential. This information will only be used to report comparisons among groups of people. We will never identify individuals or households with these responses.

45. Which of the following best describes your current employment situation? (CIRCLE ONE NUMBER)

1 Work full-time (40 hours per week or more)

2 Work part-time (less than 40 hours per week) or semi-retired

3 Work seasonally (work only part of the year)

4 Unemployed

5 Fully retired

6 Full-time student

7 Homemaker

8 Other (please describe: _____)

46. What is the highest level of education you have completed? (CIRCLE ONE NUMBER)

- 1 Less than 8th grade
- 2 Eighth grade graduate
- 3 Some high school
- 4 High school graduate
- 5 Some trade or technical school
- 6 Trade or technical school graduate
- 7 Some college
- 8 Bachelor's degree
- 9 Postgraduate study

47. What is your ethnic background? (CIRCLE ONE NUMBER)

- 1 White, Non-Hispanic-----> Are you of Scandinavian, French-Canadian, Italian, Irish, or some other ancestry? (CIRCLE ONE NUMBER)

- 1 Scandinavian ancestry
- 2 French-Canadian ancestry
- 3 Italian ancestry
- 4 Irish ancestry
- 5 Other (please describe: _____)

- 2 Hispanic
- 3 Native American
- 4 Asian/Pacific Islander
- 5 Black
- 6 Other (please describe: _____)

48. What was your total household income before taxes in 1989? (CIRCLE ONE NUMBER)

- | | |
|------------------------|-------------------------|
| 1 Under \$10,000 | 6 \$50,000 to \$59,999 |
| 2 \$10,000 to \$19,999 | 7 \$60,000 to \$69,999 |
| 3 \$20,000 to \$29,999 | 8 \$70,000 to \$79,999 |
| 4 \$30,000 to \$39,999 | 9 \$80,000 to \$100,000 |
| 5 \$40,000 to \$49,999 | 10 Over \$100,000 |

Do you have any comments?

THANK YOU FOR YOUR HELP!

Please Return This Survey To:

**HBRS, Inc.
585 Science Drive, Suite #A
Madison, WI 53711**

APPENDIX E
THANK YOU / REMINDER CARD

Dear Freshwater Angler:

A few days ago we sent you a survey asking about your freshwater fishing experiences, catch, and consumption. If you have already completed and returned the survey, please consider this a "thank you" card. If you have not done so, we hope you will return your survey soon.

Your responses to this survey are very important in helping us evaluate freshwater catch and consumption in Maine. We need your response to ensure that other anglers like yourself will be represented in this study.

We are hoping to hear from you soon. Thank you for your cooperation.

Michael P. Welsh
Project Manager

HBRS, Inc.

585 Science Drive

Madison, WI 53711

APPENDIX E

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Michael P. Welsh
Project Manager

HBRS, Inc.

585 Science Drive

Madison, WI 53711

APPENDIX F
FOLLOW-UP COVER LETTER

HBRS, Inc.

University Research Park • 585 Science Drive • Madison, Wisconsin 53711
(608) 231-1011 • Fax (608) 231-3418

Dear Freshwater Angler:

About three weeks ago, we sent you a survey about freshwater fishing in Maine. If you have already completed and returned the survey, please accept our sincere thanks. If you have not done so, we would still like to receive your completed survey.

Your responses to this survey are very important to our study. Even if you don't fish very often or feel your experiences are not typical of others, we would still like to hear from you. You are one of a small group of anglers who are being asked to represent the many different types of freshwater anglers. Your answers are very important because they reflect your views and experiences, as well as the views and experiences of other freshwater anglers like you. It is important that we hear from everyone so that the results of this study accurately show the freshwater catch and consumption in Maine.

Your responses are confidential, and your name will not be revealed. Information from the surveys will be reported only in statistical terms, such as 10 percent of freshwater fishing trips took place in Penobscot River.

I am enclosing another copy of the survey and a stamped, self-addressed envelope in case you have misplaced the first one. I hope you can take some time soon to help us out in this study.

Thank you for your cooperation in this study.

Sincerely,



Michael P. Welsh
Project Manager

P.S. In order for us to begin analysis of this study, it is important for us to hear from you by December 3. If you feel you cannot complete the survey, write me a note on the survey booklet and return it to HBRS, Inc. Or if you would rather, please feel free to call me or Lori Langer collect at HBRS, Inc. Our number is (608) 231-1011.

APPENDIX G

LENGTH-MASS RELATIONSHIP

LENGTH/MASS RELATIONSHIP

Survey respondents were asked to report the number and average length of each species of fish caught. In order to estimate the total mass of fish consumed by Maine anglers in grams per day it was necessary to approximate the mass of the fish eaten from the length data reported by the survey respondents. This was accomplished by use of the standard length to mass relationship (Cone, 1989):

$$W = C \times L^n \quad (1)$$

where

W = Mass of whole fish
C = constant (species-specific)
L = Length of whole fish
n = constant (species-specific)

Equation (1) can also be expressed as a linear regression based on logarithms (Cone, 1989; Nielsen and Johnson, 1983):

$$\log (W) = C + n \log (L) \quad (2)$$

This form of the length-mass relationship has recently been cited as most the most appropriate means by which to estimate the length-mass relationship (Cone, 1989). The parameters C and n are species-specific constants. The exact value of n is dependent on the shape of the fish, however, it usually approximates 3 (Nielsen and Johnson, 1983). In general, a value less than 3 represents a fish that decreases in girth as its length increases, while a value greater than 3 is representative of fish species for which girth increases as the fish grows longer (Nielsen and Johnson, 1983). The exact value of each parameter is affected by several variables including season, sex of the fish, sexual maturity, age of the fish, and the type of waterbody in which the fish resides. Due to this wide range of variability, the relationship for a particular species in a given river, lake or stream ideally should be determined by site-specific sampling and measurement. Because this survey encompasses fishing sites on rivers, streams, lakes and ponds throughout the State of Maine, average or approximate values were considered acceptable estimates.

For this study, logarithmic regression equations specific to the state of Maine were obtained (unpublished data, MeIFW, 1990). The equations were derived from length and mass measurements compiled over several years from numerous rivers and lakes in the state of Maine. For the species for which these equations were available, these equations are the best available generalized length-mass relationships for Maine (personal communication, J. Trial, 1991). However Maine-specific equations were not available for all species of concern. For those species for which Maine-specific equations were not available, the most appropriate relationship was selected from those reported in the available literature (Carlander, 1969, 1977).

Length-mass relationships differ for individual species depending on the type of waterbody in which the fish resides. Therefore, when possible, an equation based on composites of river and lake fish were used to represent the average. When such equations were not available, lake data was chosen. Although most of the species found in Maine rivers are also found in Maine lakes, lake-raised fish tend to be plumper. Therefore an equation which is based on fish residing in a lake would result in a higher mass estimate for a given length than an equation based on river data. There were, however, a few species for which the source of data was either unspecified or was limited to rivers. In these cases, these numbers were applied to all the survey data, as the best

available estimate. An attempt was also made to select equations based on large sample sizes. The specific equations used in the calculations are reported in Table G1 .

The lists of species in Questions 11, 23, 24, 29 and 31 grouped several species of fish together. For example, smallmouth and largemouth bass were grouped under the single heading of "Bass", and suckers, carp, and sturgeon were identified only as "Bottom Fish". Therefore, it was necessary to select one species to represent each group.

For the fish grouped under the heading "hornpout", brown bullhead was selected as the representative species. This decision was based on the fact that brown bullhead is the only catfish species listed as a local species in the text "Fishes of Maine" (Everhart, 1977). It therefore seemed reasonable to assume that the fish reported under this category were actually brown bullhead.

For the fish categorized under 'Bottom fish' sturgeon were considered an inappropriate representative as they are relatively rare in Maine waters and are, therefore, less likely to be caught (Everhart, 1977). Thus, the length to mass relationship for sucker was used because it resulted in a larger, more conservative estimated mass for a given length than the equation available for carp. Similarly, largemouth bass were chosen to represent the bass species because the equation for largemouth bass predicted a larger, more conservative mass.

Redbreast sunfish and rainbow trout have been reported to be among those species most often caught by anglers in Maine (MeIFW, 1985), however they were not included in our species list. Therefore it seemed reasonable to assume that many of the fish reported under "Other" would actually be one of these two species. The length-mass relationship used for this category was for redbreast sunfish, as it resulted in a larger and more conservative mass than that for rainbow trout.

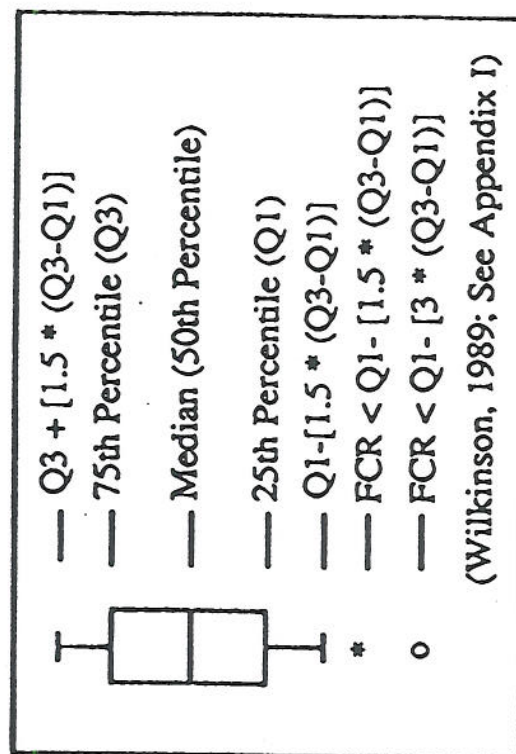
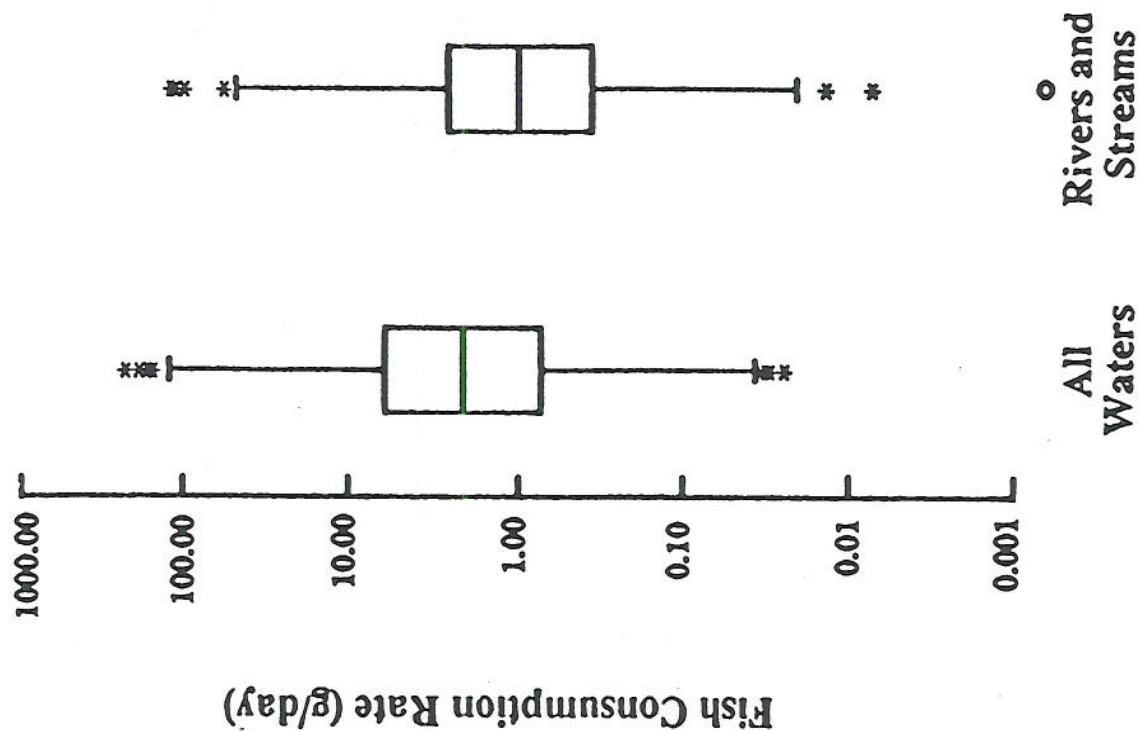
TABLE G1. WEIGHT TO LENGTH RELATIONSHIPS FOR SPECIFIED SPECIES OF FISH

SPECIES	REGRESSION $\log W(g) = C + n \cdot \log L(mm)$	SAMPLE SIZE (N)	MEAN SIZE (mm)	WATERBODY	SOURCE
Landlocked Salmon	$\log W = -5.145 + 3.035 \cdot \log L$	9582	270-750	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Atlantic Salmon	$\log W = -5.038 + 3.0 \cdot \log L$	--	--	Unspecified [Scotland]	Carlander, 1969 (Refer to P136)
Lake Trout	$\log W = -5.879 + 3.306 \cdot \log L$	4151	290-840	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Brook Trout	$\log W = -5.054 + 3.022 \cdot \log L$	4402	150-750	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Brown Trout	$\log W = -5.096 + 3.037 \cdot \log L$	2672	167-936	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Yellow Perch	$\log W = -3.519 + 2.390 \cdot \log L$	118	127-320	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
White Perch	$\log W = -5.273 + 3.177 \cdot \log L$	945	100-457	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Largemouth Bass	$\log W = -3.844 + 2.606 \cdot \log L$	261	209-686	Rivers and lakes [Maine]	MEIFW (Dr. Joan Trial)
Chain Pickerel	$\log W = -5.491 + 3.098 \cdot \log L$	87	229-566	Unspecified (Florida)	Carlander, 1969 (Refer to H202)
Lake Whitefish	$\log W = -5.677 + 3.241 \cdot \log L$	--	--	Lake Superior	Carlander, 1969 (Refer to D174)
Brown Bullhead	$\log W = -5.061 + 3.065 \cdot \log L$	1634	152-192	Lake Butte des Monts [Wisconsin]	Carlander, 1969 (Refer to P188)
White Sucker	$\log W = -5.395 + 3.223 \cdot \log L$	--	--	Shadow Mt. Lake [Colorado]	Carlander, 1969 (Refer to H268)
Creek Chub	$\log W = -3.972 + 2.98 \cdot \log L$	--	--	Des Moines River [Iowa]	Carlander, 1969 (Refer to D195)
Smelt	$\log W = -6.2 + 3.40 \cdot \log L$	938	80-220	5 Lakes in the Sebago Region [Maine]	MEIFW Rick Jordan
Redbreast Sunfish	$\log W = -4.69 + 3.01 \cdot \log L$	3937	--	Unspecified [Alabama]	Carlander, 1977 (Refer to S472)

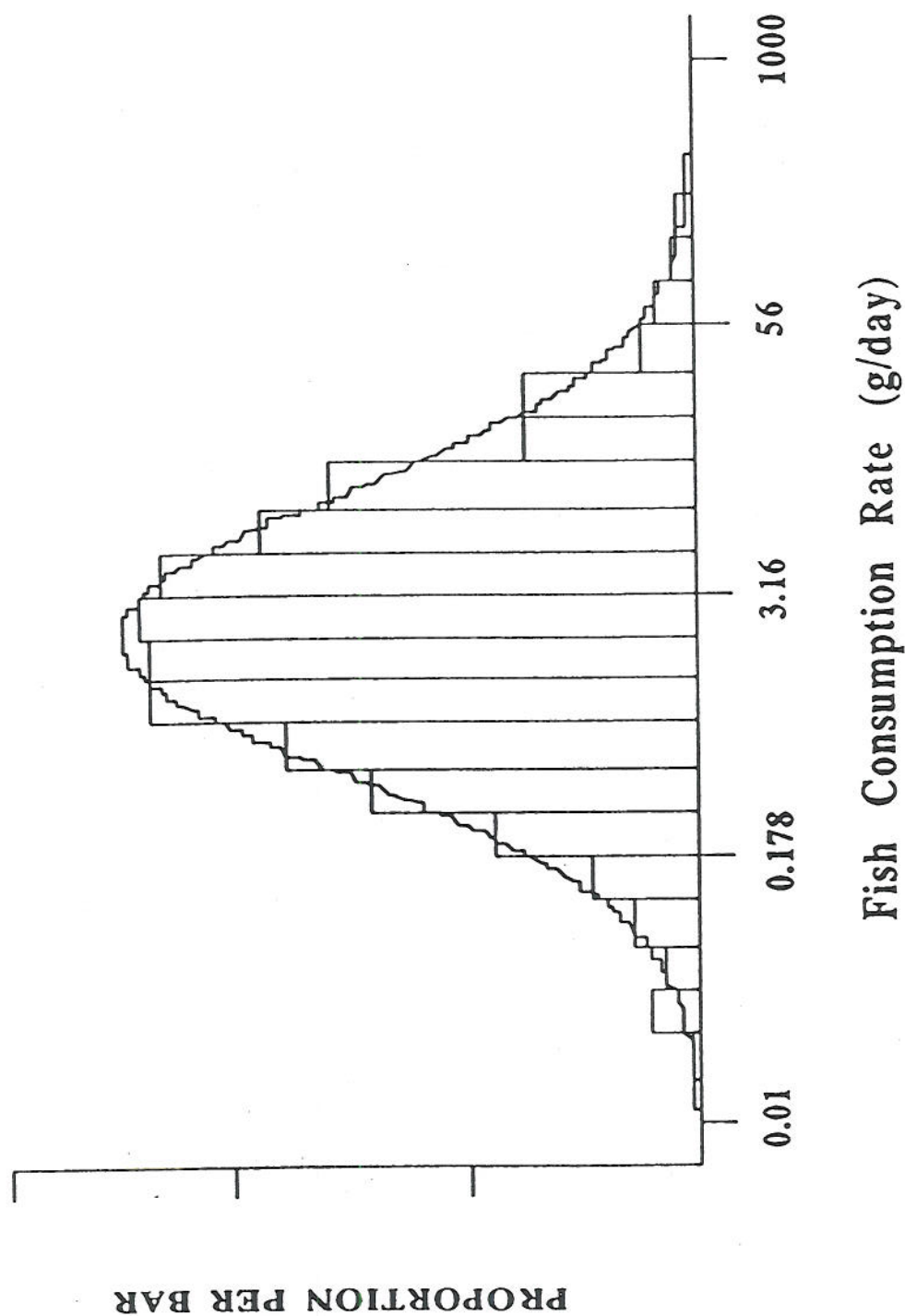
APPENDIX H

DISTRIBUTION OF THE DATA

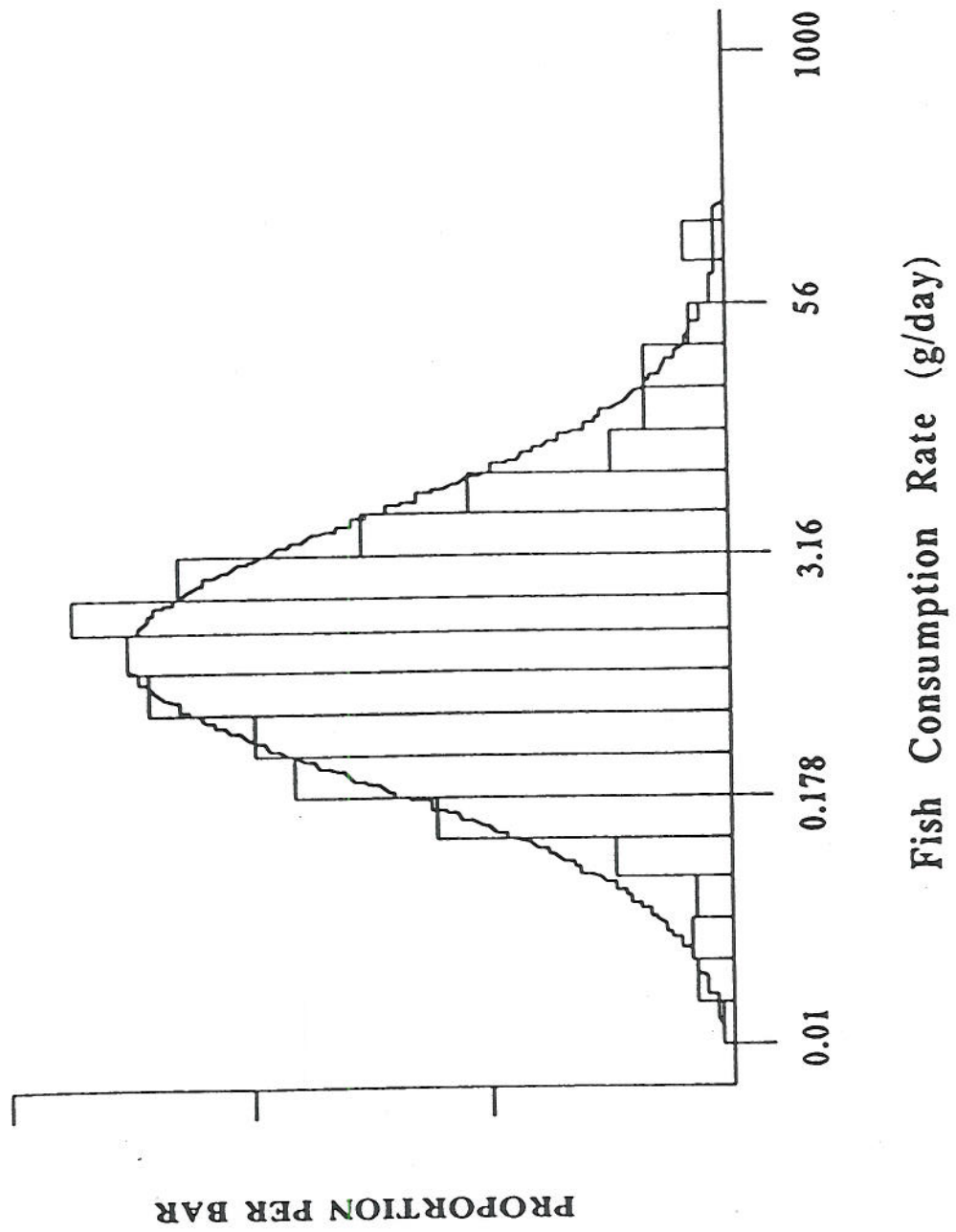
FRESHWATER FISH CONSUMPTION: CONSUMING ANGLERS



FRESHWATER FISH CONSUMPTION: ALL WATERS



FRESHWATER FISH CONSUMPTION: RIVERS AND STREAMS



APPENDIX I

INTERPRETATION OF BOX PLOTS

INTERPRETATION OF BOX PLOTS

Box plots are simple graphical summaries of five important features of data sets: (1) Location; (2) Spread; (3) Skewness; (4) Tail length; and (5) Outlying data points (Velleman and Hoaglin, 1981). These plots were originally developed by Tukey (1977; as cited in Wilkinson, 1989) and are a widely used tool in exploratory data analysis and in preparing visual summaries of data (McGill et al., 1978). Notched box plots are variations on the box plot which additionally display the approximate 95% confidence limits on the median (McGill et al., 1978). All box plots presented in this report were created using SYSTAT version 5.0 (Wilkinson, 1989) and a Macintosh SE/30 computer.

Figure 11 presents a diagram of a simple box plot and labels its features. A box plot is characterized by a central box with two "whisker" lines extending from it (Wilkinson, 1989). Asterisks or open circles may be plotted outside the two "whiskers." Location is summarized within a box plot by the median, which is displayed as the crossbar in the interior of the central box. The ends of the central box, called fourths or hinges, give an indication of the spread of the data. By definition, the central fifty percent of the observed values fall within the limits of the central box. Just as the median splits the ranked data in half, the fourths split the remaining halves in half again. The lower fourth or hinge corresponds approximately to the 25th percentile (i.e., first quartile, or Q_1) of the observed values, while the upper fourth or hinge corresponds approximately to the 75th percentile (i.e., third quartile, or Q_3) of the observed values. The length of the central box shows the fourth-spread of the data, which is comparable to the interquartile range. The relative position of the median, lower fourth, and upper fourth give an indication of the skewness of the data. If the median is much closer to the lower fourth than to the upper fourth, the data is positively skewed, i.e., the observations are not symmetrically distributed but rather are clumped near the lower end of the scale. Because the fish consumption rates presented in this report were so positively skewed, use of a logarithmic scale was necessary to show detail on the box plots.

The box plot's "whiskers" provide an indication of tail length, another measure of data spread (Velleman and Hoaglin, 1981). The limits of the whiskers are called the inner fences. By definition, the lower inner fence is located 1.5-times the fourth-spread below the lower fourth. Similarly, the upper inner fence is located 1.5-times the fourth-spread above the upper fourth. Another set of fences, known as the outer fences, are located at 3-times the fourth-spread below and above the fourths. Outer fences are not displayed on box plots. Asterisks appearing on the box plot represent individual observations outside the inner fences but within the outer fences. Open circles represent observations outside the outer fences. Both asterisks and open circles indicate outlying values.

Notched box plots are a variation of simple box plots developed by McGill et al. (1978). All the features of the simple box plot are retained in the notched box plot. Additionally, notched box plots include confidence intervals on the median at approximately the 95% level. The confidence intervals are shown as notches beginning at the median and returning to full width at the lower and upper confidence limits. Notched box plots are useful for comparing results among several groups. If the plotted confidence intervals do not overlap, then one can be confident at about the 95% level that the population medians are different. Conversely, if confidence intervals do overlap, then populations medians are not significantly different at approximately the 95% confidence level.

Figure 11. Box Plot Diagram

